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ABSTRACT

Recent research suggests that alcoholic inpatients' performance on neuropsychological tests is predictive of their drinking status following discharge from alcohol rehabilitation programs, although no single test itself has been predictive of relapse. This study seeks to develop a ecologically relevant memory test that would predict relapse and could be easily administered to alcoholic inpatients. Participants were 56 male veterans ranging in age from 21 to 66 who were inpatients in an alcohol treatment program which advocated abstinence. Participants completed the Product Recall Test (PRT), an ecologically relevant test consisting of cut-out magazine advertisements placed on cards to test memory recall. The Memory-for-Designs Test (MFD) was administered as an ecologically irrelevant test for comparison. The results indicated that significantly more subjects who recalled less than or equal to one-half of the PRT test items relapsed. The MFD test showed no relationship to relapse. Poor performance on the ecologically relevant test may be related to relapse rates because those individuals with poor recall of real world items may be less socially effective and therefore more subject to relapse. The pages of references and statistical tables conclude the report. (ABL)

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Ecological Relevance of Memory Tests and the Prediction of Relapse in Alcoholics

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Running Head: Ecological Relevance of Memory Tests

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Ecological Relevance of Memory Tests and the Prediction of Relapse in Alcoholics

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Abstract

Fifty-six males in an inpatient alcohol rehabilitation program were examined with two 10-minute memory tests: the Product Recall Test (PRT), designed by the authors to assess memory for familiar stimuli (assumed to be relatively high in ecological relevance), and the Memory for Designs Test (MFD; Graham & Kendall, 1960), a test of memory for novel patterns of stimuli (assumed to be relatively low in ecological relevance). Approximately 74% of subjects who recalled less than or equal to half the items of the PRT relapsed at 3 months compared to only 33% of the subjects who recalled more than half the items. Performance on the MFD was not related to relapse rate. PRT performance was almost as predictive of relapse at 3 months as aftercare attendance, and combining both of these variables further improved predictability. The results suggest that the familiarity of the stimuli employed in memory tests may be important in tapping cognitive deficits of alcoholics that place these subjects at increased risk for relapse. The implication of these findings for the time-effective identification of early relapsers from alcohol treatment programs are discussed.

Ecological Relevance of Memory Tests and the Prediction of Relapse in Alcoholics

The performance of alcoholic inpatients on neuropsychological test batteries has recently been found to predict their drinking status following discharge from alcohol rehabilitation programs (Abbott & Gregson, 1981; Berglund et al., 1977; Gregson & Taylor, 1977; Guthrie & Elliott, 1980; O'Leary et al., 1979; Walker et al., 1983). These findings suggest that patients with cognitive impairments may require novel interventions to overcome their cognitive deficits in order to improve their treatment outcomes (Goldman, 1983). However, studies in this area have tended to rely on lengthy test batteries of neuropsychological functioning which in the daily operation of an inpatient alcohol treatment program may be inconvenient to administer, score and interpret.

The utility of neuropsychological test batteries in predicting alcohol relapse has been limited to the overall index score, and no single test within a battery has been significantly related to relapse (e.g., Berglund et al., 1977; Guthrie & Elliott, 1980). One possible explanation for the poor predictive validity of neuropsychological battery subtests is their lack of "ecological relevance." Goldman (1983) suggested that neuropsychological tests which "closely match the behavioral requirements of the real world" (p. 1052) would have better predictive validity for alcoholics, than ecologically irrelevant tests. Thus, tests

of cognitive functioning that require skills utilized in the posthospital environment, such as memory for faces, (Becker et al., 1983), might better predict posttreatment adjustment among alcoholics than tests that employ novel or ambiguous stimuli. The neuropsychological tests used in the previously mentioned studies are relatively low in ecological relevance since they primarily tap visual-spatial memory for novel patterns or figures. For example, the Patterned Cognitive Impairment Test (Abbott & Gregson, 1981; Gregson & Taylor, 1977) requires subjects to remember the content and order of arrays of novel visual symbols presented sequentially, and the Brain Age Quotient Battery (O'Leary et al., 1979; Walker et al., 1983) consists of a series of tests of motor skills and visual-motor skills such as the Tactile Perception Test and the WAIS Block Design Test.

Ecologically relevant tests of cognitive functioning have not yet been used to predict relapse. In addition, currently developed ecologically relevant tests, while sensitive to cognitive impairments in alcoholics, are lengthy and complex to administer (e.g., Becker et al., 1983) or score (e.g., Gottschalk et al., 1983). The present research was undertaken to develop a brief, ecologically relevant memory test that could be easily administered to groups of alcoholic inpatients, and to explore the relationship between this test and relapse following participation in an alcohol dependence treatment program.

The predictive validity of this test was compared with that of an ecologically irrelevant memory test requiring the same time to administer and score. Additionally, the relative contributions of the ecologically relevant test and aftercare attendance to the prediction of outcome was assessed.

Method

Subjects

Fifty-six male veterans comprised the study sample. Subjects ranged in age from 21 to 66 years (mean = 47.1; SD = 12.5) and reported drinking problem durations that ranged from 1 to 45 years (mean = 14.6; SD = 10.9). The sample was predominantly Caucasian (72%) with fewer Black (26%) and Native American (2%) subjects. Completion of high school was reported by 76% of the sample and 23% was employed at the time of admission. Thirty-six percent of the sample was married at admission. The average daily alcohol consumption was an equivalent of 12.3 beers (SD = 6.7) reported over the 90 days prior to admission.

All subjects were inpatients in a 28-day alcohol treatment program which emphasized a social learning approach (Miller and Mastria, 1978) and advocated an abstinence goal. Treatment program components included alcohol education, self-management training, instruction in problem solving skills, assertion training, leisure skills training, vocational counseling, individual behavior therapy, and aftercare.

Test Development

To develop a brief, ecologically relevant test, magazine advertisements (e.g., from "People"), which contained color photos and written labels of common products, were cut out and placed on white 4" by 6" index cards. A total of 10 categories of products (e.g., alcohol, motor oil, sports equipment), with four unique product items per category (i.e., a total of 40 product items all with different brand names), were collected. To create a test of free recall with minimal encoding demands and high ecological relevance the familiarity of the pool of 40 product items was first assessed. Product items were rated in random order, independently, by eight male alcoholic inpatients and eight male alcohol staff members. Raters indicated familiarity of the items on a Likert scale ranging from not familiar (0) to very familiar (2). The five product categories with the highest mean familiarity ratings were chosen for inclusion in the test. The product categories chosen, in order of familiarity were: alcohol, deodorants, cereal, soft drinks, and pick-up trucks. Familiarity was high for all the product categories, with mean Likert ratings ranging from 1.85 (pick-up trucks) to 2.0 (alcohol). These 20 product items were reproduced on slides, controlling for size and angle of presentation of the product. This test is referred to as the "Product Recall Test" (PRT).

The Memory-For-Designs Test (MFD; Graham & Kendall,

1960) was utilized as a brief, ecologically-irrelevant, comparison test. This test consists of 15 novel straight-lined drawings, printed in black on a white background, and usually requires between five and ten minutes to complete (Graham & Kendall, 1960). It assesses visual memory-motor recall, similar to many of the tests composing the neuropsychological test batteries, and has been demonstrated to discriminate reliably between people differing in levels of cognitive functioning. These 15 items were also reproduced on slides to facilitate group testing.

Test Administration

The memory tests were administered to groups of eight subjects who were consecutive admissions to an inpatient alcohol treatment program. Tests were given in the 3rd week of inpatient treatment, after at least 3 weeks abstinence. Each group of eight subjects sat at tables facing a wall onto which the slides were projected. They were provided with pads of white paper and with a piece of 8-1/2" by 11" white paper. Subjects were informed that they would be given two tests, one which assessed visual-verbal memory and one which assessed visual-motor memory. They were first administered the PRT. Each slide was shown for 10 seconds (total presentation time was 200 seconds), and subjects were instructed not to write anything down until after all slides had been shown. Slides were shown in random order. Each page of the pad provided spaces to indicate the product type

(e.g., cereal) and brand name (e.g., Post). Subjects were instructed to list in any order all the product items that they recalled, using one sheet of paper per item, and without looking back at previous items. The slowest subject required 10 minutes to complete the PRT.

For the MFD test, each of the 15 slides was shown for 5 seconds in accordance with the test procedure. Subjects were instructed to write down their responses (i.e., reproduce a figure from memory) after each slide was shown. The slowest subject took 10 minutes to complete this test.

Manipulation Check

After each test was completed, the subjects' familiarity with, and the visibility of, the PRT product items and the MFD drawings were examined. All inpatients reported being very familiar with and being able to see at least 19 of the product items, and each item was recognized and visible to at least 18 people. None of the subjects reported being familiar with any of the MFD drawings and all subjects reported being able to see all 15 drawings.

Test Scoring

The PRT was scored as follows. Each response was scored as correct (score = 1) or incorrect (score = 0), based on whether the judges could recognize the brand name (e.g., Post) and product category (e.g., cereal, flakes). Scoring time was about one minute per subject. The MFD was scored according to the guidelines of Graham and Kendall (1960), in which each response was given a score between

zero points (no errors) and three points (the figure is rotated, grossly incomplete, and/or grossly distorted in shape).

Both tests were scored by a psychology resident assigned to the inpatient alcohol unit and a psychology graduate student who had never seen the subjects and was blind to the purpose of the study. Inter-rater reliability correlations were high for both tests: .93 for the PRT total score and .90 for the MFD total score. (N = 56 for both tests).

Assessment of Drinking and Demographic Variables

Drinking-related behavior and dependence symptoms were assessed using the Alcohol Use Inventory - General Scale (AUI-G; Wanberg et al., 1977) and the Alcohol Dependence Scale (ADS; Skinner & Allen, 1982), both of which were self-report measures. Data were also collected on the length of the drinking problem and average daily intake 90 days prior to admission (in 12-ounce beer equivalents), as reported by the subject and his significant others.

Follow-up

Attempts were made to contact all 56 subjects by phone 3 months post-discharge. This time period was chosen because relapse rates have been shown to level out at about that time (e.g., Hunt et al., 1971). Furthermore, Abbott & Gregson (1981) found that neuropsychological measures significantly predicted relapse at 3 months following discharge. The follow-up phone interviews were conducted by

the program evaluator who was blind to the purposes of the study. A standardized interview, based on the one used in the Rand Report (Polich et al., 1980) was used to evaluate the subject's drinking status and social functioning. Subjects estimated the number of drinking days and amount consumed on a typical drinking day for each month following their discharge from the treatment program. A similar interview was conducted with significant others to corroborate subjects' self-reports.

Aftercare sessions were scheduled every 2 weeks for the first 2 months postdischarge, and once every month for the next four months. Subjects were provided with this schedule of appointments at the time of discharge and were automatically reminded and rescheduled (via letter) if one appointment was missed without cancellation. Upon failing to report for two consecutively scheduled appointments, subjects were not reminded further. Aftercare attendance was recorded at the fifth scheduled appointment, 3 months postdischarge. This measure was a simple tabulation of whether the subject was actually present for the appointment or not.

Results

The Study Sample

Eighty-four percent of the original sample subjects (N = 47) were contacted at follow-up. According to Polich et al. (1980), and given the results of LaPorte et al. (1981), this is a more than sufficient proportion of the original

sample to draw conclusions unbiased by attrition. Demographic characteristics for the dropout group are displayed in Table 1.

Insert Table 1 about here

Abstinence Data

Total abstinence was used as the dependent measure for these analyses since abstinence was the stated treatment goal, and over 90% (N = 23) of those who resumed drinking reported levels of alcohol intake approaching pre-treatment levels by three months post-discharge. Of 47 patients who were contacted 3 months after discharge, 22 abstained from drinking (47%) and 25 (53%) did not. The drinkers did not differ from the abstainers in any of the demographic or pretreatment drink-related variables (all p's $>$ .05; Table 1).

Memory Test Analyses

Since none of the drink-related, or demographic variables differed between the abstainers and the drinkers at the 3-month follow-up period, these variables could be ruled out as mediating any differences found in the PRT or MFD scores. Differences between the abstainers and drinkers on the MFD and PRT were examined with t-tests. To protect against alpha inflation with multiple t-tests, the Bonferroni Procedure (Green, 1978) was used. The overall significance level of $p < .05$ was divided by two (the

number of t-tests performed) so that only p values less than .025 on each t-test were considered significant.

Abstainers differed from drinkers on the PRT ($t(45) = 2.4$, $p < .01$, one-tailed), with abstainers having better recall than drinkers (abstainers' mean score = 12.1, SD = 4.5; drinkers' mean score = 9.1, SD = 4.2). However, abstainers did not differ from drinkers on the MFD (abstainers' mean score = 7.1, SD = 5.8, non-abstainers' mean score = 8.8, SD = 8.4; $t(45) = 0.8$, ns).

Different PRT cutpoints were evaluated to maximize discrimination between the abstainers and drinkers. Preliminary chi square analyses indicated that a cut-off score of 10 on the PRT most accurately discriminated the abstainers from the drinkers at the 3-month follow-up time ($X^2(1) = 7.77$, $p < .005$). Using this PRT cut-off point, 70.2% of the subjects were correctly classified with respect to outcome status. Subjects with a score of 10 or below were at increased risk for relapse. Seventy-four percent of the subjects who had scores below or equal to the cut-off relapsed, compared to only 33% of the subjects whose scores were above. Overall, the percentage of abstinent and nonabstinent subjects accurately classified was 72.7% and 68%, respectively. To further assess the predictive ability of the PRT, subjects' classification based on the PRT cut-off score (i.e. $< 11 = 0$, $> 10 = 1$) was entered into a logistic regression analysis (Harrell, 1983) with relapse (abstinent = 1, relapsed = 0) as the dichotomous dependent

variable. The resulting regression model was highly significant (X^2 (1, N=47) = 8.01, p = .0047), and resulted in an R^2 of .12. This statistic is similar to R^2 in multiple correlation analysis, but due to the nature of the dependent variable, R^2 in this case, represents the proportion of log-likelihood, rather than variance, explained by the model.

Aftercare Attendance

Preliminary analysis failed to demonstrate any significant association between PRT performance and aftercare attendance (X^2 (1, N=47) = 1.79, p = .18; phi coefficient = .19). Since prior research has shown a strong positive relationship between alcohol treatment outcome and aftercare attendance (Ahles et al., 1983, Walker et al., 1983), the separate and combined effects of aftercare attendance and PRT classification were compared. The percentage of subjects accurately classified based only on whether or not they attended their fifth aftercare appointment was 72.3%. Overall, 71.4% of those subjects who attended this aftercare appointment were abstinent. On the other hand, only 26.9% of subjects who failed to attend this appointment were abstinent. The predictive power of aftercare attendance was evaluated by entering attendance at the 3 month aftercare appointment (attendance = 1, non-attendance = 0) as an independent variable in a logistic regression analysis of relapse. This aftercare attendance model was also highly significant in the prediction of

outcome (X^2 (1, N = 47) = 9.55, p = .002). The proportion of log-likelihood accounted for by aftercare attendance was 15%.

To assess the combined and relative contribution of the PRT and aftercare attendance both variables were entered simultaneously in a logistic regression analysis of relapse status. This combined model was highly significant (X^2 (2, N=47) = 15.77, p = .0004). When both variables were considered together the proportion of log-likelihood explained by the model increased to 24%, 12% above that explained when the PRT was considered alone, and 9% above that explained by the aftercare model alone. The combined predictive ability of the two variables is evident in the fact that 85% of the subjects who scored above 10 on the PRT and who attended aftercare appointments 3 months after discharge remained abstinent from alcohol, whereas only 13% of the subjects who both performed poorly on the PRT and did not attend 3-month aftercare appointments were abstinent (See Figure 1.). Importantly, both PRT performance (regression coefficient = 1.70, X^2 (1, N=47) = 5.69, p = .02, partial R^2 = .06) and aftercare attendance (regression coefficient = 1.88, X^2 (1, N=47) = 6.97, p = .008, partial R^2 = .08) were positively and significantly related to outcome, even when the effect of the other variable was controlled for. Hence, the PRT appeared almost equal to aftercare attendance in its predictive ability, and this could not be accounted for by any redundancy in the two

variables.

Insert Figure 1 about here

Discussion

The present study examined the relationship between the performance of alcoholics on two brief memory tests and their subsequent rate of relapse 3 months following their discharge from an inpatient alcohol treatment program. The Product Recall Test (PRT) was constructed to measure memory for familiar visual stimuli (commercial products), and significantly more subjects who recalled less than or equal to half the items on this test relapsed (74%) than subjects who recalled more than half (33%). In comparison, the Memory-For-Designs Test (MFD; Graham & Kendall, 1960), which measures memory for novel designs was not significantly related to relapse at 3 months. In addition, the PRT was almost as powerful as aftercare attendance in predicting relapse at 3 months (12% vs. 15% of log-likelihood accounted for, respectively), and the model combining both variables further improved the prediction (Figure 1).

The predictive utility of the PRT in contrast to the MFD suggests that ecologically relevant memory tests may be more appropriate than irrelevant tests for assessing cognitive deficits in alcoholics. The PRT requires that subjects encode, store and recall real-world items, which may lend it predictive strength. Subjects who have

difficulty recalling a variety of common products would also, presumably, have difficulty recalling daily activities and recent events. Such deficits might limit their variety of conversational topics and general fund of information and make them less socially effective individuals. To compensate for these inadequacies, they may resume drinking. Memory deficits for real world items among some alcoholics might also interfere with the amount or rate of skill acquisition in a rehabilitation program.

The PRT predicted relapse at a level comparable to several previous studies that employed lengthy neuropsychological test batteries to assess cognitive deficits (i.e., Berglund et al., 1977; Guthrie & Elliott, 1980; O'Leary et al., 1979; Walker et al., 1983). These findings, while in need of replication, suggest that memory tests that are simpler to score and administer, than full neuropsychological test batteries, may be useful in screening alcohol rehabilitation patients who are at high risk for relapse. This would facilitate individual programming by requiring a minimum of time and expertise from the staff providing the clinical services.

Several limitations to the present study must be noted. First, the PRT was designed to measure memory for familiar stimuli (commercial products), a skill that we assumed would be a behavioral requirement for functioning well in the real world. However, the actual need for this skill in the real world has not been assessed, and thus its validity as an

ecologically relevant test (Goldman, 1983) is unknown. Other studies employing "ecologically relevant" tests have also not addressed the relation between performance of these tests and real world functioning (Becker et al., 1983; Gottschalk et al., 1983). Even if the PRT did tap ecologically relevant functioning, information is lacking regarding its reliability and construct validity (e.g., specificity to alcohol-related dysfunction). Replication-extension studies are needed that: (1) compare performance on the PRT (or some analogous test) between alcoholics and nonalcoholics; and (2) correlate PRT performance with post-hospital functioning (e.g., conversational skills, performance of daily tasks, etc.).

A second limitation is that the two tests in the present study require different processing skills, and may not be directly comparable. The PRT requires the recording of verbal information, whereas the MFD requires the reproduction of spatial material. There are, however, no data to indicate that these differences in recall demands are of any predictive importance. Another concern is that the MFD has not been demonstrated to be more sensitive to cognitive dysfunction in alcoholics than previous neuropsychological tests employed in this line of research. Studies that compare the PRT to a variety of time effective but ecologically irrelevant tests are needed to make stronger claims about relative predictive abilities.

Finally, we examined relapse rates over a 3-month

period, in contrast to some other studies that examined longer outcome periods. The subgroup of subjects who performed poorly on the PRT were rapid relapsers, and the longer range prediction of the PRT awaits further investigation. However, if these results are replicated over a 3-month period, the existence of such a subgroup of rapid relapsers identified by the PRT is potentially relevant to treatment, whether or not the PRT also predicts relapse at longer intervals.

Aftercare attendance was comparably predictive of relapse as the subjects' performance on the PRT, in contrast to Walker et al., (1984), who found that aftercare attendance was a more powerful predictor of relapse at 6 months post-discharge than neuropsychological test performance. These findings suggest that individual difference variables reflecting deficits in cognitive skills utilized in the real world may operate as well as, and independently of, compliance with treatment interventions to determine the likelihood of a subject resuming drinking after participating in an alcohol rehabilitation program.

In conclusion, the present study found that a brief, ecologically relevant test of cognitive functioning (the PRT) was predictive of relapse among alcoholics and that an ecologically irrelevant test of similar length was not (the MFD). Furthermore, the prediction of relapse achieved by the PRT was as strong as that reported for lengthy neuropsychological test batteries in several of the previous

studies, although over a shorter period of time (3 versus 6 months). Future steps towards reducing relapse rates may be to involve high risk subjects in lengthier stays to allow them more time to recover from their cognitive impairment (Goldman; 1983) and to better learn self-management skills necessary for abstinence. Social learning interventions might also need to be simplified and rely more on repetition for high risk subjects than with inpatients with better cognitive functioning. Finally, new techniques may need to be developed to enable such subjects to overcome or adapt to permanent cognitive deficits, with possible attention to the environment to which the subject returns.

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Footnotes

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Table 1

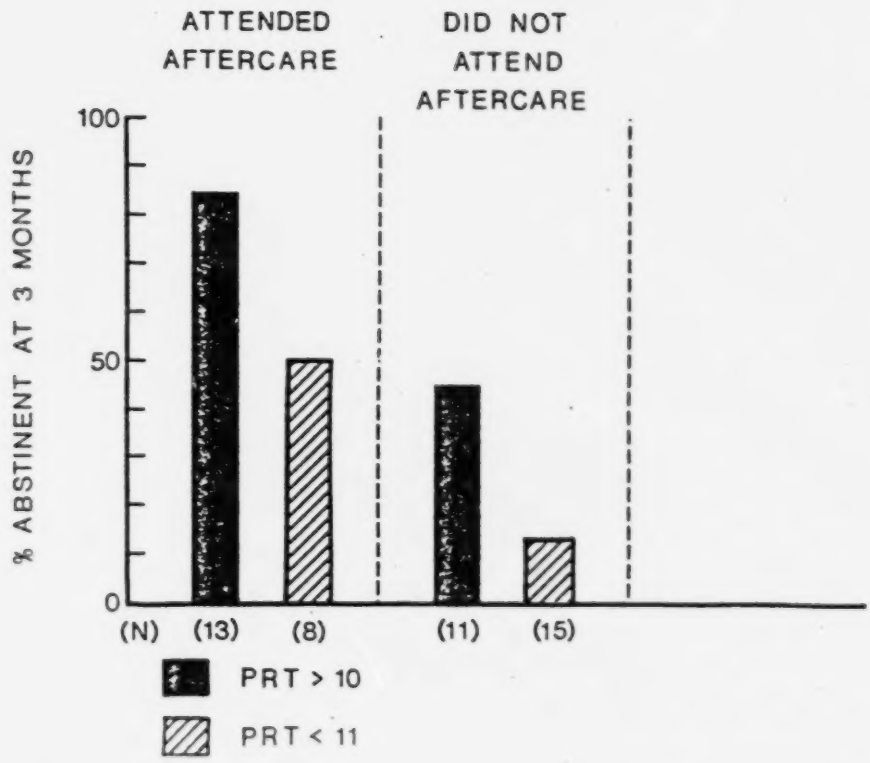
Demographic and Drink-related Characteristics of Dropouts, Abstainers, and Drinkers

Characteristic	Dropouts (N = 9)	Abstainers (N = 22)	Drinkers (N = 25)	Differences between Abstainers and Drinkers
Number of Married Patients	1	10	7	$X^2(1) = 1.5$, $p > .10$
Race	7 Whites 2 Blacks	16 Whites 6 Blacks	18 Whites 6 Blacks 1 Native American	$X^2(2) = 1.1$, $p > .10$
Age: M(SD) in years	42.7(10.0)	47.2(11.4)	46.9(13.6)	$t(45) = 0.1$, $p > .10$
Number of Employed Patients	0	14	8	$X^2(1) = 3.3$, $p < .08$
Education: M(SD) in years	12.6(0.9)	12.8(1.7)	11.6(1.9)	$t(45) = 0.3$, $p > .10$
Length of Drinking Problem: M(SD) in years	19.2(8.8)	15.7(6.4)	13.6(13.9)	$t(45) = 0.7$, $p > .10$
Daily intake 90 days prior to admission: M(SD) in beer equivalents	8.6(4.6)	12.3(2.1)	11.3(0.6)	$t(45) = 0.4$, $p > .10$
AUI-G score: M(SD)	36.9(12.3)	31.6(13.9)	27.7(13.1)	$t(45) = 1.0$, $p > .10$
ADS score: M(SD)	22.3(12.2)	18.6(10.4)	17.7(9.4)	$t(45) = 0.3$, $p > .10$

Figure Caption

Figure 1. Relations between aftercare attendence, PRT performance, and abstinence at 3 months.

Figure 1


ATTENDED AFTERCARE
DID NOT ATTEND AFTERCARE
% ABSTINENT AT 3 MONTHS
100
50
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(N) (13) (8) (11) (15)
PRT > 10
PRT < 11